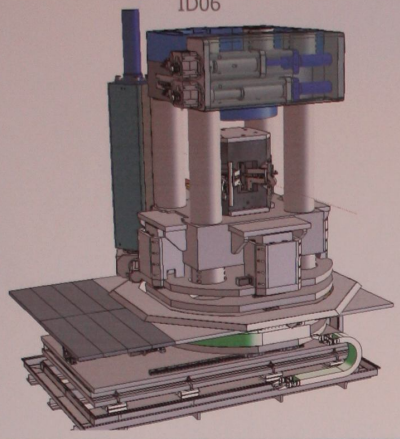
EUROPEAN SYNCHROTRON RADIATION FACILITY
6, rue Jules Horowitz – F38043 – Grenoble cedex France – http://www.esrf.fr

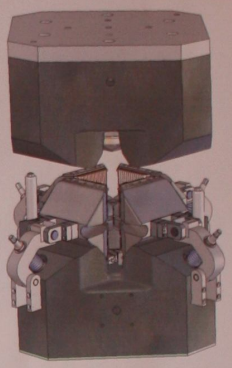
The Large Volume Press design aspects in relation to the D-DIA break analysis

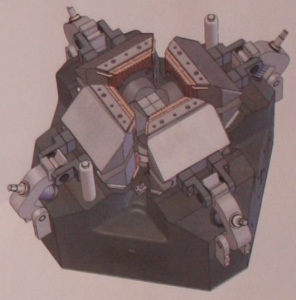
Y.Dabin[1] L. Zhang[1], M. Diot[1], W. Crichton[1]
[1] European Synchrotron Radiation Facility, 6 rue Jules Horowitz, F-38000 Grenoble, France

The Large Volume Press (LVP) is installed on ID06

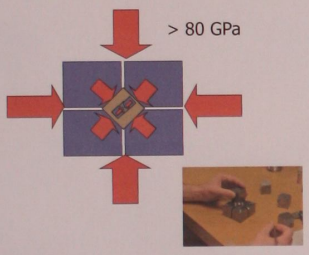


The large volume press is a 2000 Tonf hydraulic piston, moving a 3D mode compressive system
The sample pressure can reach 80 GPa





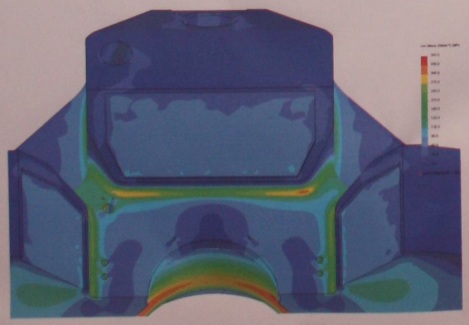
Moving wedge system
Change a vertical thrust
To a combined horizontal 2D displacement

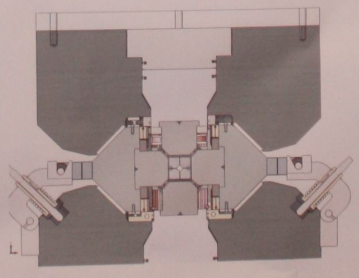


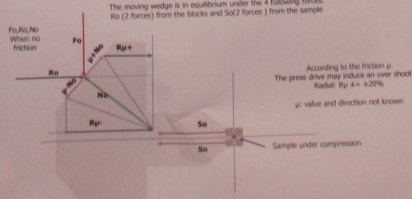
Secondary multi-anvil System changes a 1D to 3D compressive force

The Deformation diamond like system move the secondary multi-anvils

Break analysis:
Stress concentration zone
Steel 3% elongation: Fragile break





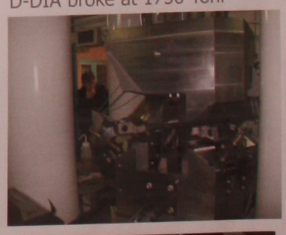


Decision of designing a security watch system:

- 45 Strain gauges record in real time (HBM supply)
- Alert system
- Vibration monitoring
- Secure max force operation presently 1700 Tf

Loading case	Total force from LVP	Pressure P1 main	Pressure P2 secondary	Force per Cubic face	Force on D-DIA wedge face	Allowable Max stress (part of σ_y)	Stress in D-DIA	
	Tf	Bars	Bars	Tf	Tf	MPa	MPa	MPa
100 % LVP	2000	800	1600	666.6	471	938	500	600/1400
90% σ_y	1800	720	1460	600	424.3	844.2	400	500/800
75% σ_y	1500	600	1200	500	353.6	703.5	352	800

Dec 2009: During an experiment the 3D device D-DIA broke at 1750 Tonf



Cracks propagation
May suggest fatigue process
But not yet identified